WELDING TORCH

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WELDING TORCH

[Schweissbrenner]

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The invention relates to a welding torch having the characteristics described in the preamble of the primary claim.

A welding torch of this type is known from DE-OS 35 45 505. Here, the cutoff safety is arranged in the wire transport direction, after the wire drive. The torch barrel is connected to the yielding part of the cutoff safety, while their housing and the wire drive form a structural unit

and are mounted jointly to the hand of a robot. The cutoff safety fulfills two functions. It serves on the one hand as an emergency switch to shut down the welding torch in the event of a collision with the workpiece. On the other hand, it is utilized as a contact switch in order to locate the points of reference on the welding path. In both cases, arranging the cutoff safety after the wire drive has proven to be disadvantageous for wire guidance. For a swinging movement of the torch barrel with cutoff safety, the wire in this section, which has only just been advanced, must be deflected. This can have a disadvantageous effect on the uniformity of the wire advance.

A similar arrangement is known from US-PS 4 540 869, which is burdened with the same problems.

It is therefore the purpose of the present invention to indicate a welding torch having a wire drive and a cutoff safety which features a higher level of operating safety in combination with a more favorable wire guidance and an improved ease of operation.

The invention solves said problem with the features described in the characterizing portion of the primary claim. According to the invention, the cutoff safety now is seated in the wire transport direction before the wire drive, such that a deflection of the wire only can take place ahead of the wire drive, thus, in the draw region. After the wire drive, the welding wire is advanced in straight lines without deflections. This precludes any disturbance in the wire advance.

In addition, structural advantages and an improved ease of operation of the welding torch is yielded since, by shifting the cutoff safety upward, the tool-center-point, or end of the torch barrel moves forward, nearer the hand axis of a manipulator or industrial robot. This brings greater freedom in the torch selection and of the mobility of the robot hand with the welding torch, which now can better reach even difficult-to-access locations on the workpiece. In addition, control is simplified and there is more space in the region of the torch barrel for the mounting of ancillary components, such as a welding sensor or similar. The welding sensor can have, in addition, a dedicated mobility. As a whole, the structural length of the welding torch can be shortened substantially.

With an upper cutoff safety, the distance from the torch barrel end to the pivot point in the cutoff safety increases. In the event of a collision of the torch barrel with an obstacle, this yields a substantially greater [amount of] coasting and a greater braking distance for pivoting angles that remain the same. Therefore, the welding torch can be moved at higher speeds than before without the danger of damage.

The cutoff safety itself can be of various designs, with a construction corresponding to DE-OS 35 45 505.5 being recommended. In any case, the movable part of the cutoff safety is connected to the wire drive and torch barrel and also to possible ancillary components, while the cutoff safety or the housing thereof is mounted to the hand of a manipulator.

According to the invention, outside supplied lines for operating material such as inert gas, cooling agent, current, and guide for the welding wire are connected to the movable part of the cutoff safety or to parts of the welding torch arranged thereupon. Within the adjoining areas of the wire drive, torch barrel or possible additional sets, continued placement of the relevant lines is in a rigid manner. This arrangement offers substantially greater line elasticity in the event of yielding movement of the torch. There is no need to connect the line bundle first to a relatively stationary point, such as the cutoff safety housing or to the robot hand and to guide same from there, in short kink-susceptible lines, to individual parts of the torch. Instead, the lines have a large amount of free length, and additionally the elasticity of the hose available in the event of corresponding deformations is greater, such that during a yielding movement they are placed under less stress than before and have an increased durability and operational reliability.

A welding torch according to the invention is suitable especially in combination with industrial robots, for which it has specific advantages. The construction of the welding torch permits, namely, a diminution of the overall size and weight of the torch. A welding torch according to the invention thus also may be utilized on a smaller robot. In addition, a welding torch according to the invention also can find use on simpler manipulators, tool guides or other similar apparatuses.

Additional advantageous configurations of the invention are indicated in the subclaims. For the use of a cutoff safety with a pivoting index plate, it is recommended to mount the wire drive and the torch barrel, or the housings thereof, to said index plate by means of a collar. The design of the cutoff safety housing with two webs spaced apart from one another enables a space-saving construction and a favorable weight distribution.

The invention is represented in examples and schematically in the drawings. Shown in detail are:

Figure 1 A robot having a welding torch, in side view,

Figure 2 An enlarged representation of a welding torch, in side view,

Figure 3 The welding torch of Figure 2, in top view and

Figure 4 The welding torch in a variation from Figure 2, in a front view according to Arrow IV.

Figure 1 shows a six-axis industrial robot (1), on the hand (6) of which is arranged a welding torch (2). The torch is supplied from a roll with welding wire (4) in a hose (19), which wire emerges at the end of the torch barrel (10) toward the workpiece. The arrangement shown is developed for inert gas welding, e.g., with carbon dioxide. The inert gas and additional operating material likewise are supplied to the torch by means of the hose (19) in a line bundle (27) (compare Figures 2 and 4).

The welding robot (1) is utilized for automated welding, whereby it also searches for and tracks the seam path. If necessary, a welding sensor (25) can engage in a correcting manner (compare Figure 2). The welding torch (2) features a wire drive (3) and a cutoff safety (5), with the latter serving as an emergency cutoff in the event of a collision with the workpiece and as a signal transmitter in order to search for the seam path. In order to track the seam path while welding, a welding current-dependent torch height control is provided, if necessary in combination with a pendulum movement of the torch. For the embodiment shown, the wire drive (3) is developed as a 2-roll drive. However, it can be configured in any different manner, e.g., as a spin head or 4-roll drive.

Figures 2-4 reproduce the construction of the welding torch (2) in detail.

As is evident from Figures 2 and 4, the cutoff safety (5) is arranged in the wire transport direction (22) before the wire drive (3) and, in particular, before the drive rollers (23) thereof. The drive rollers (23) are located, for an extended robot hand (6) roughly at the height of the hand axis (28). The cutoff safety (5) is arranged above said robot axis (28).

The complete wire drive (3) with the motor (11) thereof, gearing (24), drive rollers (23) and additional parts is carried together with the torch barrel (10), on the movable part of the cutoff safety (5), here, an index plate (14). The housing (8) of the cutoff safety (5) in contrast, is mounted to the flange plate (7) of the robot hand (6). In the event of a collision of the torch barrel (10) with the seam flank or another part of the workpiece, the wire drive (3) and the torch barrel (10) with index plate (14) yield jointly. The welding wire (4) conducted by means of a guide barrel (13), due to the rigid connection of the torch barrel (10) to the wire drive (3), thus is always guided in a straight path by the drive rollers (23) up to emergence at the end of the torch barrel.

The cutoff safety (5) features an orbicular index plate (14), which is in circuit with, either directly or indirectly, several switching contacts (15), here in the form of sensitive micro-switches. The index plate (14) is pressed by means of springs (17) and, laterally guided, is supported against the bottom edge of the housing (8). Arranged apart from this in the housing (8) are turning retainers (16), with the aid of which the index plate (14) can be aligned and adjusted.

The index plate (14) possesses a collar (29) projecting downward out from the housing (8), to which the housing (18) of the wire drive (3) is detachably mounted by means of a tension ring (30). The two housings (8, 18) are arranged one over the other with sufficient free space for movement. The torch barrel (10) is mounted to the wire drive (3) by means of a quick-action closure (26) in a way permitting quick exchange. The quick-action closure (26) has a fork that engages corresponding recesses of the torch barrel (10), pressing the latter in a sprung manner into a receiver. Thus, the wire drive (3) and torch barrel (10) are suspended from the index plate (14).

Should the torch barrel (10) meet with an obstacle, it yields inclusive of the wire drive (3), whereby the index plate (14) tips or axially lifts off about the pivot point (21) thereof against a resetting spring force (17). This causes one or more of the sensitive micro-switches (15) uniformly distributed about the periphery to be opened; these deliver a corresponding signal to the control of the robot (1). The index plate (14) reacts to excursions of the torch barrel (10) in any direction. After being eased, the index plate (14) returns automatically to its starting position.

As clarified in Figures 2 and 3, the housing (8) of the cutoff safety (5) is connected to the flange plate (7) by means of two webs (9) laterally spaced from one another. Starting from the flange plate (7), the webs (9) extend upward to the housing (8). Thus, the upright drive motor (11), having lateral motional latitude, finds sufficient space between the webs (9). This scales down the size of the welding torch (2) and shifts the motor weight nearer to the manipulator hand (6).

Only one connection (12) for the signal line is arranged on the housing (8) of the cutoff safety (5), which is relatively stationary in comparison to the robot hand. In contrast, the current and signal line for the wire drive (3) is guided on the relatively mobile drive housing. The various lines discharge above into the line bundle (27). The funnel-shaped hose nozzle (20) also is mounted to the housing (8).

The line bundle (27) itself is clamped only at the upper end of the hose nozzle (20) and otherwise is guided laterally and freely through the hose nozzle (20) and index plate (14). Arranged in the collar (29) in the area of the connection to the drive housing (18) is a line connection (31) in the form of a plug-in connector. One half of the coupling is connected to the line bundle (27) and combines the various cables and lines for inert gas, cooling water etc. with forward and backward motion as well as the welding wire guidance. It is fixed in the coupling position by means of a tensioning screw (32) and a cone in the collar (29). The other half of the coupling is mounted to the drive housing. From here out, the individual lines in the drive housing (18) and in the torch barrel (10) are laid in a rigid manner. The welding wire (4) is guided by means of a guide barrel (13) between the drive rollers (23) and reaches into the torch barrel (10) by means of a second such barrel.

In the event of a yielding movement of the torch barrel (10), the plug-in coupling (31), inclusive of the rigidly laid lines, moves therewith. A compensating movement of the lines does not take place until above the plug-in coupling (31) in the area up to the upper end of the hose nozzle (20) and in the adjoining hose (19). Because of the large amount of free deformation length, the lines can elastically receive the yielding movement without problem.

The underside of the drive housing (18) offers a defined interface (36) in the form of a justified flange surface for the attachment of ancillary components. In the embodiment of Figure 2, a welding sensor (25) with the housing (33) thereof is mounted here. It possesses a sensor

barrel (34) carried in a pivoting manner and movable by means of a drive that encloses the torch barrel (10). The sensor element (35) is accommodated in the sensor barrel (34) and projects from one end thereof. The sensor element functions, for example, with a light beam reflected from the workpiece, the shape of which is optically detected and evaluated. Through a rotary actuator, the sensor element (35) also can track curved seam progressions and be correspondingly aligned.

Parts list

1 Manipulator, robot
2 Welding torch
3 Wire drive
4 Welding wire
5 Cutoff safety
6 Hand, robot hand
7 Flange plate
8 Housing
9 Web
10 Torch barrel
11 Drive motor
12 Connection
13 Guide barrel
14 Index plate
15 Switching contacts, sensitive micro-switches
16 Turning retainer
17 Spring
18 Drive housing
19 Hose
20 Hose nozzle
21 Pivot point
22 Wire transport direction
23 Drive rollers
24 Gearing
25 Welding sensor
26 Quick-action closure
27 Line bundle
28 Robot axis, hand axis
29 Collar

30 Tension ring
31 Line connection, plug-in coupling
32 Tension screw
33 Sensor housing
34 Sensor barrel
35 Sensor element
36 Interface

Claims

1. Welding torch having a wire drive and a cutoff safety, characterized in that the cutoff safety (5) is arranged in the wire transport direction (22) before the wire drive (3).

2. Welding torch of Claim 1, characterized in that the wire drive (3) and the torch barrel (10) are carried on the cutoff safety (5) in a way permitting mobility.

3. Welding torch of Claim 1 or 2, characterized in that the cutoff safety (5) is connected to the hand (6) of a manipulator (1).

4. Welding torch of Claim 2 or 3 characterized in that the cutoff safety (5) features an index plate (14) carried in a pivoting manner in the housing (8) and provided with switching contacts (15) and onto which are mounted the wire drive (3) and torch barrel (10), with the housing (8) being mounted on the hand (6).

5. Welding torch of Claim 4, characterized in that the index plate (14) features a collar (29) projecting through the housing (8) and onto which the drive housing (18) is mounted in a detachable manner.

6. Welding torch of Claim 2, 4 or 5, characterized in that the housing (8) features two webs (9) spaced apart from one another for mounting on the hand (6) and which enclose parts (11) of the wire drive (3) with lateral clearance.

7. Welding torch of Claim 1 or one of the following, characterized in that the line connections (31) for the operating means of the welding torch (2) are arranged on a movable part of the cutoff safety (5) or of the welding torch (2).

8. Welding torch of Claim 1 or one of the following, characterized in that an interface (36) for the connection of additional sets is arranged on the wire drive (3).

9. Welding torch of Claim 8, characterized in that arranged on the wire drive (3) is a mobile welding sensor (25), the housing (33) of which, with the sensor drive, is mounted at the interface (36) and the rotating sensor barrel (34) of which encloses the torch barrel (10) and the end of which carries a sensor element (35).

FIG.1

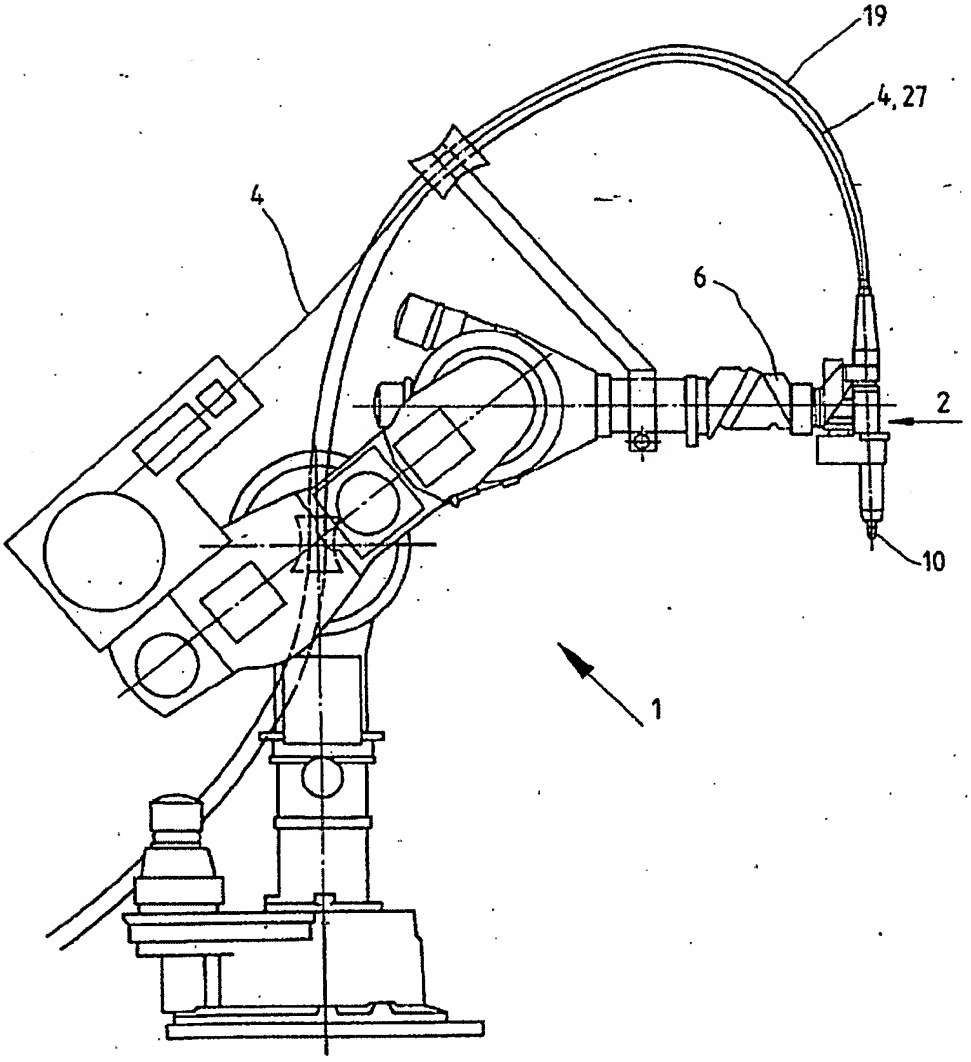

FIG.2

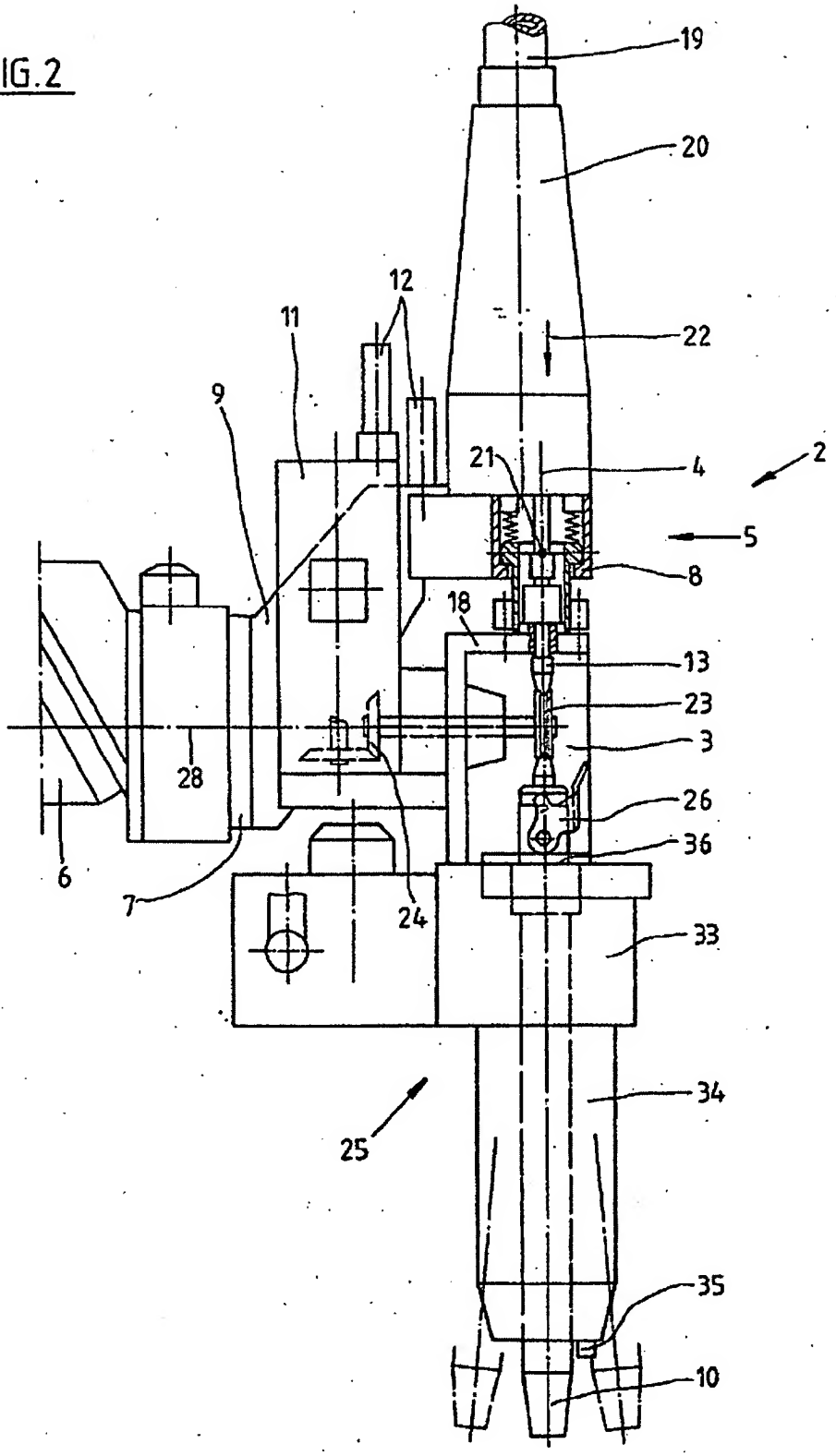

FIG.3

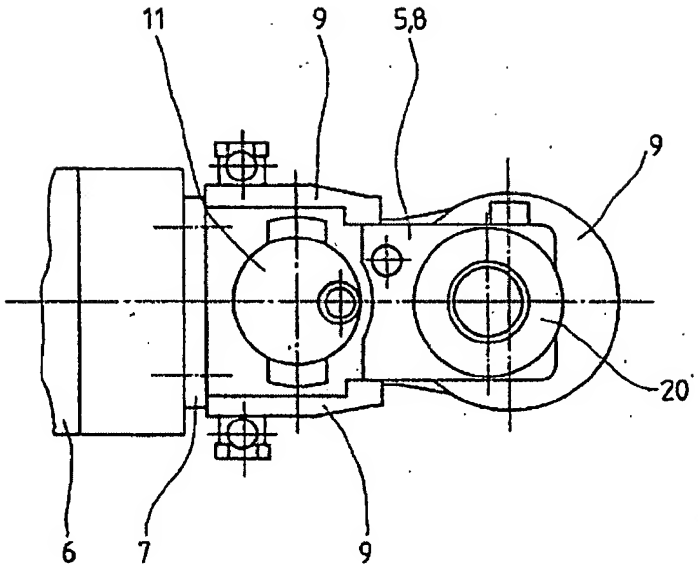

FIG. 4